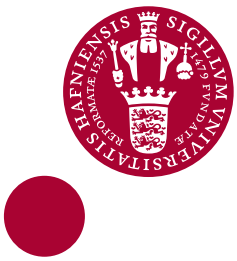

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Breeding Blues: An ethical evaluation of the plan to reduce calving difficulties in Danish Blue cattle[1]

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Abstract
Danish Blue Cattle is a breed of cattle originating from the Belgian White Blue Cattle (BWB), a breed that is characterized by double muscling, which in turn may lead to difficult calving. In Belgium, difficult calving in this breed is typically pre-empted by means of planned caesarean sections (CS). The breed association, under some pressure from its parent organisation the National Cattle Committee, first implemented an action plan to reduce the rate of CS following a media event and subsequent reactions from politicians in Denmark in 1998. Later, the breed association renamed the breed from Belgian White Blue to Danish Blue Cattle in an effort to distance the breed from its Belgian origin. The aim of this paper is to undertake an ethical evaluation of how this issue was handled, with specific focus on the actions of the breed association and the National Cattle Committee. This evaluation involves an objective assessment of the outcome of the action plan as well as a wider ethical assessment of the rationale and actions of the professional organisations in charge. We begin by describing the controversy in 1998, which led to the aforementioned action plan. Then, we evaluate how successful the action plan has been in achieving its stated goals. These results show that the action plan has achieved a decrease in the rate of CS from over 50% between 1990-1998 to below 10% between 2000-2013. There has also been a significant decrease in the rate of other types of difficult births in the breed. Finally, we evaluate the implementation of the action plan from the perspective of professional ethics, where the aim is to handle public controversies in such a way as to maintain acceptance from the surrounding society. This has clearly been a success. However, viewed from a consequentialist perspective with a focus on animal welfare, the outcome is more ambiguous. The welfare for Danish Blue cattle has improved, but on the other hand the breed still has a much higher level of CS than comparable breeds of cattle in Denmark.

Key words: Professional ethics; animal welfare; caesarean section; Belgian White Blue Cattle

Background
The Belgian White Blue (BWB), also known as Belgian Blue, is a modern cattle breed originating from Belgium, where it was formally established in 1973. The characteristic double muscling of the breed arose as a natural recessive mutation in the myostatin gene. Double-muscled individuals of local Belgian breeds attracted high slaughter prices in the 1950s. With the introduction of cattle caesarean section (CS) around the same time, it became possible to routinely deliver double muscled calves. This motivated breeders to select bulls that were guaranteed to pass on the double muscling gene mutation. These bulls were used for artificial

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insemination so that over time more and more calves were double muscled; and eventually a separate breed, BWB, was established with double muscling as one of the breed's main characteristics (Lips *et al.* 2001).

BWB was introduced in Denmark in 1972, and the breeding of BWB quickly increased among a small group of devoted breeders. In 1978 there were 297 purebred BWB registered in Denmark, and in 1979 a breed organisation for Danish BWB was established (Stendal 2004). The main role of BWB in Denmark has been, and still is, to produce semen that can be used for inseminating dairy cows so that offspring not planned be used as replacement heifers can be used for more efficient meat production. When used for this purpose, the offspring will not be double muscled as they possess only a single copy of the myostatin gene.

Danish breeders of BWB have also successfully engaged in export of bulls and semen to other countries and were part of international collaboration led by Belgian breeders. Production of beef cattle is not a big business in Denmark; and it is fair to say that breeding of BWB in Denmark was considered partly as a hobby for those involved (Stendal 2004).

In the 1990's concerns were raised within the breed organisation about the high frequency of CS, which was regularly above 50%; and in the mid-1990's there was a controversy about the breed in Denmark's neighbouring country, Sweden. The Swedish government wanted to ban the breed, but the European Court ruled that such a ban would not be in accordance with EU law (the aim of which is to secure the free movement of goods, including recognized cattle breeds, across the borders of the countries within the EU) (Stendal 2004).

In May 1998 the issue became a public controversy in Denmark due to a television documentary where BWB was used as an example of extreme breeding. There was a reaction from the minister of animal welfare legislation in Denmark, and pressure was put on the cattle organisations to deal with the issues. Therefore, the issue became a matter of professional ethics. The aim of this paper is to document and discuss how the Danish BWB association together with its parent organisation, the National Cattle Committee, handled the issue.

The public controversy and how it was handled by the breed organisation

In the aforementioned TV documentary, two veterinarians were shown performing a preventive CS on a BWB cow; after which another cow was shown with a series of visible CS scars. The owner of the cow on which the CS was performed was subsequently reported to the police for breaking the Danish Animal Welfare Law (Stendal 2004). The case was heard by the Veterinary Health Council, which concluded that the law had *not* been violated.

However, the Veterinary Health Council also submitted a letter to the Ministry of Justice, which at that time was responsible for the Danish Animal Welfare Law and stated that it was problematic 'from the point of view of animal ethics to continue the breeding of animals where a significant frequency of birth difficulties can be foreseen'. In the letter the council also asked that the Danish Council for Animal Ethics, an advisory board to the minister, should be consulted regarding the ethical acceptability of maintaining breeds 'where birth difficulties often occur' (Det Dyreetiske Råd 1998).

Meanwhile, the cattle organisations acted very quickly on their own. Even before the above statement was made public, the Danish BWB association had presented an action plan for BWB in Denmark. According to sources with close ties to the organisation (Stendal 2004; Hansen

2004) the action plan came into existence after strong pressure from the National Cattle Committee.

The action plan was finalized and sent to the minister on the 15th of June 1998 – less than three weeks after the broadcast of the documentary. The stated goal of the plan was to bring down the level of CS in the Danish BWB from about 50% to approximately 10% within a timeframe of 5-10 years. The main purpose of the plan was to keep double muscled BWB but to breed the animals in a way so that CS would be required less frequently. The breeding efforts included selection of bulls which were known not to cause birth difficulties in their offspring, and a focus on managing the diet of the in-calf animals in such a way as to be leaner at parturition and therefore better able to give birth. A ban on routine preventive CS was also part of the plan (Det Dyreetiske Råd 1998, Bilag 2).

Subsequently, the minister asked the Danish Council for Animal Ethics to make a statement on the issue. In this statement the Council endorsed the idea of an action plan that could serve as a basis for a voluntary agreement between the professional organisations and the Danish society represented by the minister.

A meeting was held between the minister, the Danish BWB association, various other cattle and agricultural organisations, the Veterinary Health Council, and the Danish Council for Animal Ethics. The conclusion of that meeting was that the Danish BWB breeding organisation should report back to the Danish Council for Animal Ethics on a yearly basis, and that the Council should follow the development and report back to the minister.

The only subsequent main addition to the original action plan was in 2005, when it was decided that BWB heifers should not be inseminated with semen from BWB bulls so that double muscled calves would be restricted to second (or later) calvings when the cow is fully mature.

Outcome of the action plan

Calving data for purebred BWB animals covering the period January 1985 – October 2013 were received from the Knowledge Centre for Agriculture, Denmark. Due to comparatively small numbers of recordings, observations prior to 1st January 1990 were discarded. This left a total of 5169 birth observations, of which 906 were discarded due to missing dam identification and 734 were discarded due to one or more implausible calving interval recorded for the associated 121 dams, leaving 3529 birth observations of 1791 male, 1660 female, and 78 missing-sex calves from a total of 1353 unique dams and 335 unique sires.

An overview of the distribution of 2951 recorded live births and 316 recorded still births over time is shown in Figure 1 (excluding the 262 recordings that were missing birth status). The proportion of stillbirths over time appears to be relatively consistent, however the recorded birth rate increases dramatically between 1997-1999, followed by a decline to pre-1997 levels. This most likely represents a varying voluntary reporting rate to the breed association rather than a true change in birth rate over time. Note that the final year of recordings (2013) is incomplete.

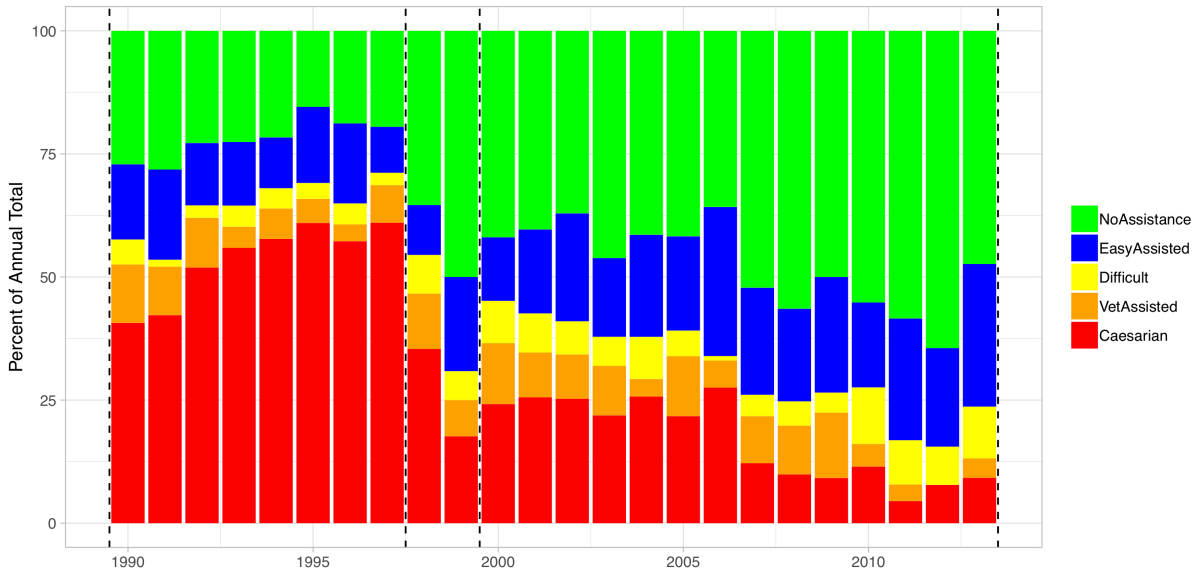

Figure 1: The recorded number of live and stillbirths of purebred calves during the time period January 1990 – October 2013, stratified by year. The dotted lines demarcate the periods of interest as follows: the pre-phase before the action plan, a two-year intermediate phase, and a subsequent post-plan phase.

Over the entire time period, there were a total of 2868 births with recorded calving score within the following categories: 1123 No Assistance, 508 Easy Assisted, 170 Difficult, 227 Vet Assisted, 840 CS. The relative distribution of these within the total number observed for each year is shown in Figure 2. There is a noticeable change in the relative rate of these recordings over time, particularly in terms of the proportion recorded as CS, which suddenly decreases around the broadcast in 1998 and continues to decline towards 2013.

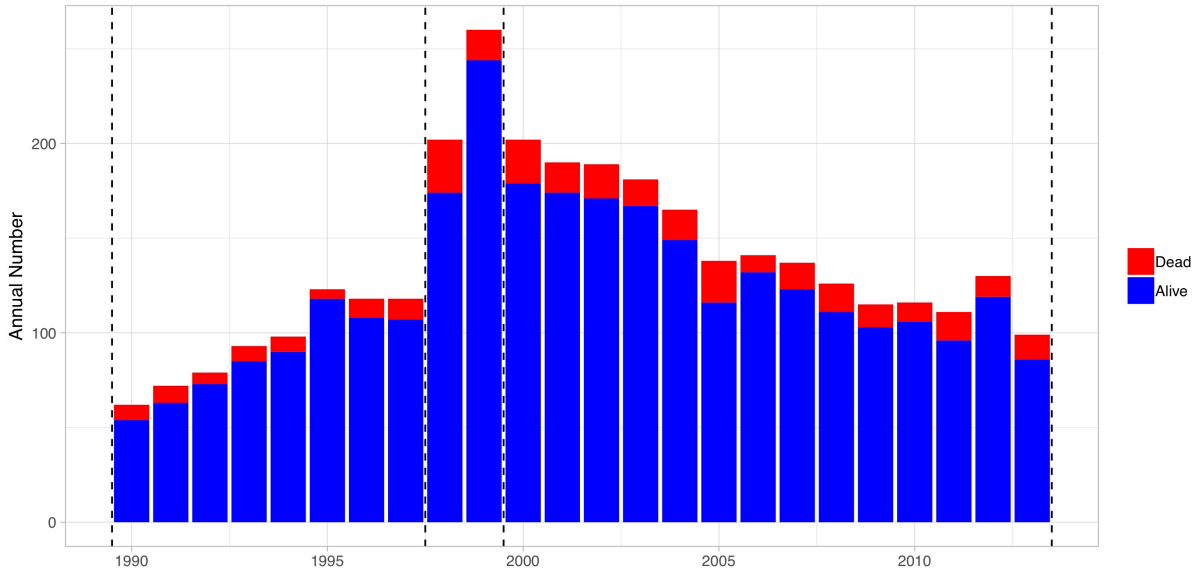

Figure 2: The recorded relative frequency of each calving score category for purebred Danish BWB cattle during the time period January 1990 – October 2013, stratified by year. The dotted lines demarcate the periods of interest as follows: the pre-phase before the action plan, a two-year intermediate phase, and a subsequent post-plan phase.

Statistical analysis of the data presented was done using three generalised linear mixed models, as follows. Model 1 was a mixed effects logistic regression with recorded birth status (live or dead; N=3220) as the response, model 2 was a mixed effects logistic regression with recorded CS (no or yes; N=2855) as the response, and model 3 was a proportional odds mixed effects logistic regression with the ordinal variable of calving score (no assistance, easy assisted, difficult and vet assisted; N=2017) as the response and excluding observations of CS. Fixed effects of calf sex and time interval (which was divided into a pre-phase before the TV documentary (1990-1997), an intermediate phase (1998-1999), and the post phase (2000-2013)) were used for all models along with a random effect of dam ID. The models were implemented using lme4 version 1.1-14 (Bates *et al* 2015) and ordinal version 2015.6-28 (Christensen 2015) packages for R version 3.4.2 (R Core Team, 2017).

The results indicate that there is no significant association between time period and stillbirths (model 1). However, the results for model 2 indicate significantly higher odds of CS in the time period 1990-1997 relative to 2000-2013 (odds ratio (95% CI): 24.74 (15.35-42.92) $p<0.001$) as well as the time period 1998-1998 relative to 2000-2013 (odds ratio (95% CI): 1.96 (1.27-3.06) $p=0.003$). Similarly, the results for model 3 indicate significantly higher odds of 'worse' calving scores (excluding CS) in the time period 1990-1997 relative to 2000-2013 (odds ratio (95% CI): 1.80 (1.28-2.54) $p<0.001$) although not for 1998-1998 relative to 2000-2013 (odds ratio (95% CI): 1.08 (0.78-1.48) $p=0.646$). The interpretation of this is a large and significant reduction in the reported rate of CS following the intervention, as well as a significant (although smaller) improvement in the reported non-CS calving scores over the same time period.

The overall conclusion is that the action plan has successfully achieved its main purpose of reducing the level of CS in BWB in Denmark and has also concurrently reduced the reported rate of difficult calving. However, the changing number of reported births during the period (with a peak in 1999 that is approximately 4 times the smallest reported number in 1990) is a potential for concern, as this changing number of reported births may be due to a reporting bias within the community. It is conceivable that such a reporting bias could have changed over the time period, and that this may partly explain the significant associations between time period and rate of CS and difficult births. Further work is therefore required to investigate the cause of the observed variation in reported birth rate over time, as well as to investigate the reasons for the data quality issues that resulted in almost 32% of the data being discarded, before the results presented here can be regarded as conclusive.

Assessment of the development from two ethical perspectives

The Danish BWB association with support from its parent organisation kept sending reports of progress regarding the action plan at regular intervals until 2013 to the Danish Council for Animal Ethics. The council followed up on these with reports to the minister, and meetings with the organisations were held in 2005 and 2008 (Det Dyreetiske Råd 2013).

Meanwhile, an interesting development took place regarding the Danish BWB association. It changed the name of the breed to Danish Blue Cattle, the name of the association to the Danish Blue Cattle association, and it broke its formal ties to the Belgian organisation. The background for this decision was a confrontation with the Belgian breeders at a conference in July 2011, where representatives from all countries present apart from the Belgians reportedly expressed concerns about the calving issue. In contrast, the Belgian representatives saw no reason for concern (Landsforeningen for Belgisk Blåhvidt Kvæg i Danmark 2011), which prompted the

Danish organisation to decide to change the name of the organisation and breed, and distance itselves from the Belgian breeders, as the British breed association had already done in 2007. It was also part of the stated background for the decision of the Danish BWB association that the company in charge of dairy cattle breeding in Denmark, VikingGenetics, had expressed concerns about delivering semen that could be associated with the Belgian breeding practice, where it is claimed that around 90% of BWB calving take place by means of CS (Landsforeningen for Belgisk Blåhvidt Kvæg i Danmark 2011).

It is noteworthy that a significant shift in mentality occured among the Danish breeders between the start of the process and 2011: Initially, the concern about reducing the level of CS was often described as sensationalist overreaction from the surroundings (Hansen 2004; Stendal 2004), whereas in 2011 the Danish Blue breeders seem to share this concern.

The Danish authorities' monitoring of the breeders of Danish Blue Cattle came to an end in 2013. In a letter from the Danish Knowledge Centre for Agriculture dated 29 November 2013, it is reported that the frequency of CS for Danish Blue Cattle for three subsequent years, 2010-2012, was below 10% (Videncentret for Landbrug 2013). In light of this information the Danish Council for Animal Ethics decided to recommend the ministry to close the case.

In the letter from the Knowledge Centre, there is a table comparing calving rates of Danish Blue Cattle with those found in four other common beef breeds: Simmental, Blonde, Charolais, and Limousine. Interestingly, for all these breeds in the three mentioned years the frequency of CS is below 1%, whereas Danish Blue ranges between 6 and 9 % (Videncentret for Landbrug 2013). The Danish Council for Animal Ethics notes that it would be good for the Danish Blue Cattle to reach the same low level of CS as the other breeds of beef cattle, but that this most likely is not a realistic goal.

Viewed from the perspective of professional ethics, the main purpose of an action plan as described in this paper would be for professional organisations to handle public controversies in such a way as to maintain acceptance from the surrounding society. From this perspective, the development has clearly been a success.

However, viewed from a consequentialist perspective with a focus on animal welfare, the outcome is more ambiguous. On the one hand, the welfare of Danish Blue Cattle appears to have substantially improved based on the reported data – both by limiting the reported rate of CS and the potential negative consequences following this, and by simultaneously achieving a reduction in the reported rate of difficult calvings. But on the other hand, the breed still likely has a much higher level of CS calving than comparable breeds of beef cattle; and from this perspective it could be argued that instead of continuing to breed Danish Blue Cattle there should instead be shift to a breed with lower levels of CS. Of course, it is debateable to which extent a CS gives rise to welfare problems (Vandenheede *et al*. 2001).

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